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ABSTRACT

The purpose of this investigation was to determine if open education and grouping students according to ability would result in greater achievement in mathematics than might occur in a heterogeneous, self-contained classroom. Four treatment groups, ability grouped and open teaching, heterogeneous and open environment, homogeneous and self-contained environment, and heterogeneous and self-contained, were employed. The first two groups were team taught. Data were analyzed utilizing an analysis of covariance for the four groups. The pretreatment mathematics subscore served as a covariable for analysis of the post achievement mathematics subscores. Chi-square was used to determine differences in interaction patterns. Results indicated no differences between the groups on achievement of mathematical concepts, but a small difference favoring the groups which were not team-taught. Students in homogeneous classes reported more friction in their classrooms than those in heterogeneously grouped classes. There were no differences on the competition scales. (Author/SD)

THE EFFECT OF OPEN CONCEPT EDUCATION AND ABILITY GROUPING ON ACHIEVEMENT LEVEL CONCERNING THE TEACHING OF FIFTH GRADE MATHEMATICS

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Purpose

This investigation was undertaken to determine what the effect of grouping students according to ability and of utilization of a team teaching approach on student achievement in mathematics is. The effect of these variables upon student perception of the learning environment and upon differences in the pattern of classroom interaction were also investigated.

Need for the Study

A National Education Association (NEA) bulletin (1968) lists the pro's and con's which have evolved relative to ability grouping. The origin of ability grouping is not clear but research related to its effect upon students first occurred in the early 1920's. The NEA bulletin lists as a first advantage, the pupils ability to progress at his own rate with other students of the same ability. Another of the advantages listed relates to the individual attention given students when they are in a more homogeneous group. Finally, it discusses challenging the pupil and the lowering of academic standards in a heterogeneous setting. In an excellent and comprehensive discussion of reviews of literature, the same bulletin remarks that some reviews conclude that there is an advantage for ability grouped students, others; that there is a slight advantage for non-ability grouped classes, and still others; that there is no difference. Some of the discussion is related to where any

advantage is greatest, i.e. at which level of ability. Eash (1961) relates that there is evidence to suggest that such grouping can, by the development of social climate, assist development of perceptions of self, attitudes toward other children, and a sense of dignity and worth for the students. Martin and Pavan (1976) concludes that arguments against ability grouping include the adverse effects upon self-concept, especially those in lower groups, the incongurence of ability grouping with real life situations, and the possible assistance and learning that the presence of the more able student may provide for the slower students. They further point out that in studies that have compared homogeneous and heterogeneous grouping, other variables affecting outcome have also been present such as changes in teaching method and materials.

A number of studies, Davis and Tracy (1963), Dewar (1963) Provus (1960), and Wallen and Vowles (1960), have dealt specifically with mathematics content at the elementary level and what the effect ability grouping for this situation may be. The pattern of results is very similar to that which was suggested earlier for the issue of ability grouping in general. This is supported by Miller and Frank (1970) who as a result of a review of some twenty experimental studies involving math instruction concluded that no final decision on homogeneous grouping could be drawn. Hence the question of what effect ability grouping has upon the student has not, in general, reached any concensus.

Martin and Pavan (1976) hint at the influence of other variables. One of the innovations often incorporated in classroom

practices is that of team teaching. Martin and Pavan list advantages of this method as exposure to the strengths of individual teachers, to variety of style, and flexibility of approach. Bais and Woodward (1964), and Burchyett (1972), conclude that there is no difference in academic achievement due to team teaching while Luedeis-Salmon (1972) concluded that team teaching results in a more active classroom.

Thus again the pattern of results is not clear. Martin and Pavan (1976) again urge consideration of other variables that may confound team teaching effect and suggest the need for definitive answers to the issue. Arlin (1974) supports this by indicating a need for research concerning the teaching of mathematics in an open environment. Paige (1967) as a conclusion to a study on team-teaching indicated the need for further research before school systems adopt team teaching.

In spite of the common utilization of the terms, ability grouping and team teaching, and of the apparent use of the method in the schools of this land, considerable uncertainty exists as to any benefits that these may include. Affective factors need to be considered more emphatically. Combinations of variables also need to be addressed as well as some clarity of definition of terms. The investigators, based upon the pattern of results, hypothesized no difference in achievement and no difference in perception of the learning environment. Scarcity of research on interaction patterns in such settings resulted in the investigators stating no hypotheses related to this aspect of the investigation.

Procedure

The authors and two graduate students trained by the researchers served as experimenters in this investigation. The subjects for this study were 125 fifth grade students enrolled in four elementary schools located in a large Southwestern urban area. Four treatment groups were involved in this study. One group of fifth grade students were ability grouped and team teaching was employed. The ability grouping was based on mathematics performance as measured by SRA Achievement Test, Form E (1974). The team teaching was such that one teacher was primarily responsible for mathematics instruction, but other teachers within the grade level assisted. A second group was heterogeneous in composition and team taught. A third group was homogeneous and of middle ability, as determined by scores from the SRA Achievement Test, Form E, and was instructed in a self-contained classroom setting. The fourth group was a heterogeneous group in a self-contained classroom. This resulted in a 2 (grouping pattern) x 2 (team-teaching) factorial design. The schools were selected to represent a range in size from approximately 500 students to over 1500 students. Further, the selected schools were to embody different organizational patterns with respect to classroom organization and staffing procedures. Because of school district policies and restraints, it was not possible to utilize randomization in this investigation. Instead, the four treatment conditions were selected from two adjacent school districts in an upper-middle class, suburban area.

Since the study focused on mathematics instruction and because Brookover (1965) has demonstrated that general academic

self-concept is distinct from learning environment perceptions, three instruments were employed: the SRA Achievement Test, Form E and F, Flander's Interaction Analysis (1970), and the My Class Scale (Anderson, 1973).

The Science Research Associates Achievement Test, Form E was administered in September, 1974. Form F was administered in April, 1975. These two tests measure the same mathematical concepts, only the individual test items are different so as to avoid compromise. A trained observer, utilizing Flander's Interaction Analysis, visited each classroom on four randomly selected occasions during the period of the experiment. On each occasion, fifty minutes of classroom interaction was coded. During April, 1975, the My Class Scale was administered to determine perceptions of the learning environment.

Results

Multifactor analysis of variance and covariance were employed to analyze the data from this two (team-taught or self-contained) by two (ability grouped or heterogeneous) factorial design. The mathematics subscale scores and the total mathematics score were analyzed by analysis of covariance with the corresponding score from the achievement test administered in early fall serving as the covariable. The results of the My Class Inventory were analyzed using a 2x2 analysis of variance technique. Table 1 provides means, standard deviations, and cell size for each of the cells of the design for each of the subscales of the mathematics test and of the My Class Inventory.

The analysis of the math subscale scores and total by analysis

of covariance produced the following results. On the mathematics concepts subscale, no significant main effects or interaction were observed. The mathematics computation subscale means were found to differ for the team-taught and self-contained groups (F=4.72) with the self-contained main effect mean exceeding that of the team-taught classes. No differences resulted from analysis of the total of the mathematics concepts subscore and mathematics computation subscore.

Results of the analysis of the subscales of the perceptions of the learning environment as measured by the My Class Inventory are presented in this section. Analysis of the satisfaction subscale produced a significant grouping main effect (F=42.8). The mean of the heterogeneous classes exceeded that of the ability-grouped classes suggesting greater satisfaction in the heterogeneous situations. Both main effects were found to be significant for the friction subscale. The mean of the ability-grouped classes exceeded (F=31.5) that of the heterogeneous classes and the mean of the team-taught classes exceeded (F=29.1) that of the self-contained classes. Thus greater friction was perceived in ability-grouped classes and in team-taught classes. No differences were observed, however, in perception of competition. The difficulty subscale provided a significant interaction (F=11.3) with the mean of the self-contained, ability-grouped class perceiving greater difficulty than the team-taught, ability grouped while the team-taught, non-grouped perceived greater difficulty than the self-contained, non-grouped subjects. The cohesiveness subscale revealed that the heterogeneous setting was more cohesive than was

the ability-grouped setting (F=19.3). An interaction (F=12.8) was also revealed with the students in the team-taught setting perceiving greater cohesiveness than those in the self-contained setting when ability-grouped. The non-grouped sections did not differ.

Tables 2, 3, and 4 reflect summarizations of the four observations of each of the four instructional settings. No inferential analysis of this data was undertaken.

Conclusions

The effect of ability grouping and of team-teaching on mathematics achievement remain inconclusive. The finding that single teacher units result in greater computational skill for students may be an indication of more drill and practice activities in this type of setting than in the team taught setting. This, however, was not determinable from the results of the interaction analysis. The mathematics concepts subscores and total mathematics achievement scores were not found to differ for any treatment condition. This suggests that the individually taught classes may be advantageous to the student when the increased computation skill is considered.

The students perceptions of the learning environment uncovered a more concise body of evidence for heterogeneous grouping. Students in these settings were more satisfied, experienced less friction, and felt more cohesiveness in the classroom than did those inability-grouped settings. Each of these findings can be explained by considering the possibly greater competition with peers, and

thus anxiety and pressure, that are attributed to ability-grouping (Martin and Pavan, 1976). This is weakened, however, by the failure to find differences in perceptions of competition in the learning environment, i.e. evidence of the effects of competition are present but competition itself is not perceived.

Interaction effects are the only revelation of an advantage to team teaching and may also reveal an advantage of the consideration of several relevant variables simultaneously. The use of team teaching in a homogeneous setting seemingly reduces perceptions of difficulty and increases feelings of cohesiveness.

Consideration of the summarization of the results of the Flanders Interaction Analysis (1970) included in Table 3, reveal some interesting patterns. Among these are the greater percentages of teacher direct behavior (lecturing, giving directions, and criticizing or justifying authority) for the team taught settings, the greater percentage of student behavior (student talk-response and student talk-initiation) for the self-contained settings, and the greater percentage of silence in the team taught setting. These are seemingly directly contrary to the suggestion of greater activity (Luedeis-Salmon, 1972) in team-taught classes.

Table 4 reveals several common products from use of the Flanders Interaction Analysis. The steady state ratio reflects the tendency for the interaction pattern to remain stable (Flanders, 1970). The data reveal that the self-contained, ability grouped setting was the more stable with interaction being student centered whereas the pattern of the team-taught, ability-grouped setting changed more rapidly with teacher behavior and silence dominating. The content cross ratio reflects the degree to which

focus was on the subject matter, and the activeness of the teacher in the pattern. A mythical average would be 55 per cent (Flanders, 1970) and thus each of the four settings is low. The ability-grouped settings ordinal position on this ratio (first and second) suggests greater motivation and fewer discipline problems in these settings.

The strength of this study lies not in the definitiveness of its conclusions but instead in the consideration of grouping method and teaching method simultaneously and in the utilization of an affective measure as well as an achievement measure and of the interaction analysis. One may never be able to state which of these instructional settings separately is the better but when more of the factors which the classroom setting involves, are combined and varied perhaps a pattern of results will emerge which will allow prediction of pupil and teacher behavior.

This study had several shortcomings which must be considered as well while interpreting these results. The breadth of the study is a major weakness, as is the fact that it was not experimental. In addition utilization of the Flander's Interaction Analysis technique is suspect as the most appropriate device for the variety of setting included in this study.

TABLE 1
MEANS AND STANDARD DEVIATIONS BY GROUPS

	Team Taught				Self - Contained			
	Ability-Grouped		Not Grouped		Ability-Grouped		Not Grouped	
No. of Subj.	31		30		18		46	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
Mathematics Concepts	27.4	7.0	25.6	6.6	24.8	7.6	29.1	7.1
Mathematics Computations	29.0	7.4	27.3	8.4	26.9	8.3	31.7	6.6
Mathematics Total	56.4	13.7	52.8	14.5	51.2	16.4	59.9	14.8
Satisfaction	14.5	5.1	19.8	2.5	16.2	2.9	20.2	3.8
Friction	20.3	3.2	22.5	1.7	17.2	2.4	20.2	2.5
Competition	22.0	2.7	20.9	2.9	20.5	1.8	21.9	3.0
Difficulty	14.3	2.9	15.7	2.1	15.6	2.3	13.6	2.6
Cohesiveness	18.8	3.2	19.3	2.3	15.9	2.0	19.8	2.4

TABLE 2
PERCENTAGE OF RESPONSES IN CATEGORY
FOR EACH TEACHING METHOD

	Team Taught		Self-Contained	
Category	Ability Grouped	Not Grouped	Ability Grouped	Not Grouped
1	0.0	0.0	0.3	0.0
2	1.5	0.5	1.0	0.5
3	0.0	0.0	6.7	0.0
4	9.1	4.5	7.9	5.1
5	9.1	10.0	15.5	2.0
6	23.7	29.0	5.5	24.0
7	4.0	1.5	0.3	1.5
8	5.6	1.5	16.8	1.0
9	4.0	17.5	31.0	34.5
10	42.9	35.5	14.2	30.5

TABLE 3
PERCENTAGE OF TEACHER DIRECT- AND INDIRECT-
AND STUDENT VERBAL BEHAVIOR

	Team Taught		Self-Contained	
	Ability Grouped	Not Grouped	Ability Grouped	Not Grouped
Teacher Indirect Behavior	10.6	5.0	16.2	5.6
Teacher Direct Behavior	36.9	40.5	21.4	28.4
Teacher Total Behavior	47.5	45.5	37.6	34.0
Student Behavior	9.6	19.0	47.8	35.5
Silence	42.9	35.5	14.3	30.5

TABLE 4
STEADY STATE AND CONTENT CROSS RATIOS
FOR TEACHING METHOD

	Team Taught		Self-Contained	
	Ability Grouped	Not Grouped	Ability Grouped	Not Grouped
Steady State Ratio	20.7	30.5	58.1	27.4
Content Cross Ratio	30.8	20.5	23.5	14.2

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